Automatized analysis of interferometric measurements on nanosecond pulsed discharge in liquid water

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Fundamental physics of the discharge development in dielectric liquids is still a subject of controversy. While the modern plasma physical concepts describe phenomena in low-temperature gas-discharges with relatively high precision: from microscopic charge multiplication by electron avalanching to macroscopic parameters such as temperature, this is not the case for discharges in liquid phase. The crucial problems of primary electron multiplication in bubble-free liquid, picosecond timescales conditioned by molecular density, and dielectric properties of polar water molecules exposed to fast changing external electric field, constitute permanent challenges for physicists. One of the method to experimentally reveal the fast micro-physics taking place in mentioned discharges is the Mach-Zehnder interferometry for evaluation of changes in refractive index of studied media. This can be further used to estimate the pressure or electric field distribution which is generated by the nanosecond high-voltage pulse applied onto the metal electrode inserted in the water.

In this contribution the interferograms generated for studied discharge case (see Fig.1) will be analysed and appropriate methods for automatic processing will be proposed. Evaluated data will be compared to the manually prepared results and the quality critically reviewed. Such an automatized approach will enable processing of large amount of experimental data using advanced statistical methods. We expect that a new inside into the phenomena of nanosecond discharges in liquid media can be revealed. This contribution is funded by Czech Science Agency grant no. 18-04676S.

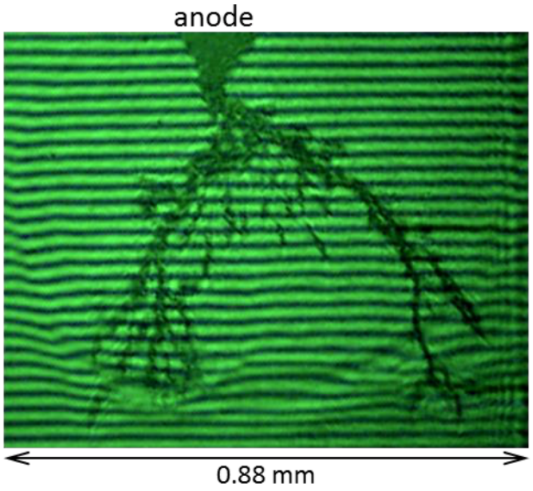

Figure 1: *Typical interferogram of the pulsed discharge in water media, taken from [1].*

References

[1] Hoffer P. 2014 Shock waves generated by corona-like discharges in water, doctoral thesis, CTU, Praha, Czech Republic